An Assessment of Environmental Problems Associated with Recycling of Hazardous Secondary Materials

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Staff members of the Resource Conservation and Recycling Branch, Office of Solid Waste, EPA Headquarters were responsible for providing objectives of the study, reviewing the methodology, helping to identify cases for further investigation, reviewing draft writeups and drafting portions of the report. The EPA Work Assignment Managers were David Eberly and Tracy Atagi. Dave Fagan and Amy Lile were key contributors and reviewers.

Staff of ICF Environmental Consulting, Inc. were responsible for identifying and investigating potential cases, assembling relevant information, contacting persons with knowledge of selected cases, drafting descriptions of each case, and compiling summary statistics. EPA wishes to acknowledge the contributions made by ICF staff members Stephanie Barrett (Research Manager), Brandy Bones and Jennifer Brickett.

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I. Introduction

This study was conducted as part of the U.S. Environmental Protection Agency's effort to revise the current "definition of solid waste" under the Resource Conservation and Recovery Act (RCRA), as it pertains to recycling of hazardous wastes and other hazardous secondary materials. The information in this report is expected to assist the Agency in making decisions as to the scope and substance of these regulatory revisions.

In an October 28, 2003 Federal Register notice, EPA proposed to revise the definition of solid waste by excluding from regulation hazardous secondary materials that are "generated and reclaimed in a continuous process within the same industry." See 68 FR 61558, October 28, 2003. That regulatory proposal resulted in more than two hundred comments being submitted to the Agency, from a wide range of stakeholders. In general, the commenters' reactions to the proposal were less than favorable, for various reasons, and many commenters suggested alternative approaches to resolving issues associated with the current definition of solid waste.

A number of commenters to the 2003 proposal criticized the Agency specifically for not having conducted a thorough study of the potential impacts of these regulatory changes. These commenters expressed the general concern that de-regulating hazardous recyclable materials in the manner proposed could result in mismanagement of materials, and thus could create new cases of environmental damage that would require remedial action under federal or state authorities. Some of the commenters further cited a number of examples of environmental damage cases that were attributed to hazardous material recycling, including a number of sites listed on the Superfund National Priorities List (NPL).

In deliberating as to how to proceed with this rulemaking effort, the Agency decided that additional data on recycling damage cases, as well as data on successful, environmentally beneficial recycling practices, would benefit the regulatory decision process, and would provide stakeholders with a clearer picture of the hazardous material recycling industry in this country. Accordingly, EPA chose to conduct these recycling studies, and consider their findings, before making decisions as to the appropriate direction for this rulemaking. This report documents the findings of the Agency's study of environmental problems that have been associated with hazardous material recycling. A separate report entitled "An Assessment of Current Good Practices for Recycling of Hazardous Secondary Materials" documents current good practices for recycling of hazardous secondary materials, and is also part of the administrative record for this rulemaking effort. In addition, a study of the economics of hazardous material recycling, entitled "Potential Effects of Market Forces on the Management of Hazardous Recyclable Materials" is part of the record.

II. Scope of the Study

The general goal of this study was to identify and characterize cases of environmental damage that have been attributed to some type of hazardous material recycling activity, and that are relevant for the purpose of this rulemaking effort. Specifically, we sought to identify the following types of cases:

- *Cases where environmental damage can be attributed to some type of recycling activity.* In conducting this study, we wished to identify damage cases in which environmental damages were caused by some type of recycling-related activity. In this context, "recycling-related activities" included accumulation or storage of materials by the generator, the recycler or an intermediary, illegal disposal or abandonment of recyclable materials or recycling residuals, transportation of recyclable materials, "sham" recycling operations (i.e., illegal disposal or treatment disguised as recycling), production and/or use of contaminated products from recycled materials, reclamation and/or production processes, management of residuals from reclamation or production processes, or other activities associated with the management of recyclable materials, recycling residuals, or the products of recycling processes.

  This study did identify a number of cleanup sites at which a recycling process had operated, but where other sources of contamination made it extremely difficult to determine with any certainty that the recycling activity contributed to the environmental problems at the site. These cases were not included in our compilation of damage cases.

- *Relatively recent cases.* Many of the damage cases that were examined in the course of this study occurred before RCRA, CERCLA or other environmental programs were established in the early 1980s. As a number of commenters on the 2003 proposed rule noted, these environmental programs – most notably, the liability provisions of CERCLA – have created strong incentives for proper management of recyclable materials and recycling residuals. Several commenters further noted that because of these developments, industrial recycling practices have changed substantially since the early 1980s, and present day generators and recyclers are much better environmental stewards than in the pre-RCRA/CERCLA era. Thus, they argue, "historical" recycling-related damage cases are not particularly relevant or instructive with regard to modifying the current RCRA regulations for hazardous material recycling. The Agency generally agrees with this viewpoint, in part because our companion study of current good hazardous material recycling practices has documented that responsible generators and recyclers do make considerable efforts to ensure that materials are recycled and otherwise managed in a safe, environmentally protective manner.

  In the course of this study it became apparent that while the CERCLA statute and the initial RCRA hazardous waste regulations became effective in 1980, there was an initial "phase in" period during which industry and other affected entities began to change their practices with regard to hazardous material recycling, and during which federal and state agencies were developing guidelines and procedures for implementing these new authorities. Perhaps not surprisingly, our study identified a number of recycling damage cases that occurred during the early 1980s that appeared to have been caused by companies and individuals who were not cognizant of their new responsibilities and potential liabilities under RCRA and CERCLA. Because we believe that recycling damage cases that have occurred within the current environmental regulatory and liability systems are most relevant to the definition of solid waste rulemaking effort, our study identified and described only those cases in which some form of environmental damage appears to have occurred during or after the year 1982. We did not however, exclude cases where damages occurred both before and after 1982.

- *Cases involving recycling of regulated hazardous wastes, or hazardous secondary materials that are specifically excluded from RCRA regulation.* This study was intended to identify damage cases associated with recycling of regulated hazardous wastes, as well as cases involving recycling of hazardous materials that are not regulated because they are subject to a specific regulatory exemption or exclusion (see, for example, the exclusions in 40 CFR 261.4). The Agency is interested in these types of damage cases because they may indicate the extent to which environmental damages can occur even when recycling is conducted under a stringent regulatory regime, and whether such damages may be more or less prevalent for materials that are explicitly exempted or excluded from RCRA regulatory controls. The study was not designed to identify cases involving recycling of non-hazardous materials such as paper, glass, rubber or plastics.

III. Methodology

The initial task of this study was to identify recycling-related environmental damage cases that were relevant to the scope and purpose of the study (the preceding section of this report describes the types of cases that were considered relevant to the study). Potential cases were identified from a variety of sources, including:

- Comments on the October 28, 2003 proposed rule
- The Superfund National Priorities List
- National EPA data bases maintained for the CERCLA, RCRA and enforcement programs
- Contacts with staff in state environmental agencies
- Contacts with staff in EPA Regional Offices
- State agency data bases maintained for state superfund programs and other environmental programs
- Internet searches
- News media reports

It should be noted that because of time and resource limitations, the search for potentially relevant damage cases was not exhaustive. For example, we did not systematically survey all state environmental agencies for relevant cases, nor did we search paper files in EPA Regional Offices. Because of these limitations, we believe that the cases we have identified and described in this report in effect represent the cases that were relatively easy to find, and that there are likely to be a significant number of additional relevant cases that we did not identify.

Once a potentially relevant case was identified, EPA's contractor personnel assembled relevant information to determine whether or not the case fit within the scope of the study. If the damage case was considered a likely candidate for the study, further information was gathered with the intent of identifying certain key facts about the case that the Agency believed would be particularly informative for the purpose of this rulemaking. These key facts included:

- Name, location and EPA Identification Number (if available) of the site
- Types of materials that were recycled, or intended to be recycled
- The government program responsible for overseeing the cleanup of the site, and whether or not the site is or was listed on the Superfund National Priorities List (NPL)
- Brief description of the site

- Basic site history, including when the recycling occurred, and when the environmental damage occurred
- Basic description of the recycling process
- The type(s) of environmental damage that occurred
- The types of activities or circumstances that caused the environmental damage
- Whether or not human health impacts, including deaths, were associated with the damage
- Whether or not those responsible for the environmental or human health impacts were prosecuted for criminal violations
- Whether the materials were recycled on-site (i.e., at the generating facility) or at an off-site recycling facility
- Whether or not the recycler went bankrupt or otherwise went out of business
- Whether or not the recycling facility had a RCRA Part B permit for managing hazardous wastes[1]
- Cost of cleaning up the site
- Other information that could help identify why the environmental damage occurred

Many of the cases that were investigated were well documented, and we were able to assemble virtually all of this information. This was the case, for example, for many of the Superfund NPL sites. However, in many other cases it was not possible given the limitations of the study to document all of these facts. Often, there was considerable technical information as to the nature and extent of the contamination at the site, but relatively little information regarding the activities and circumstances that originally caused it. For some of the sites, we were able to collect only very basic information.

For each of the 208 cases that fit within the scope of the study, a written description was prepared, and key data for each site (as available) were entered onto a summary table. The summary table is presented as Appendix 1 of this report, and is organized alphabetically by State. Appendix 2 contains each of the 208 case descriptions, organized in the same way. Appendix 3 is a listing of the damage cases that were reviewed but were not investigated in detail, either because they did not fit within the scope of the study, or because there was insufficient information to make that determination.

IV. Summary of Findings

This study identified 208 cases in which environmental damage of some kind occurred from some type of recycling activity, and that appeared to clearly fit within the scope of the study, as described above. In this context, we used the term "environmental damage" broadly, to include leaks, spills, dumps or other types of releases of hazardous substances into the environment that were serious enough to require some type of cleanup action. It also includes situations in which materials were abandoned (e.g., in warehouses) without having been actually released into the environment, but which posed potential threats and thus required removal actions that were conducted by one or more government agencies, and involved expenditure of public funds.

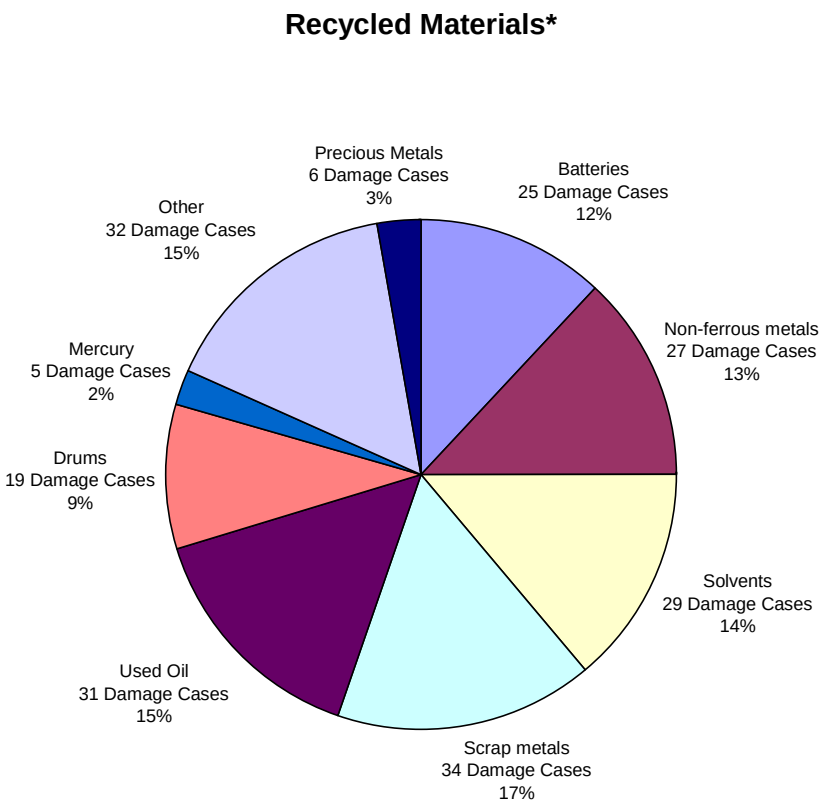
[1] Note that RCRA Part B permits are not required for hazardous waste recycling processes or operations themselves; in general, Part B permits are issued, as applicable, for storage of hazardous wastes prior to recycling.

We did not include in the study cases in which environmental regulatory violations occurred, but did not result in actual damage to the environment or to human health. For example, we found a number of cases where recycling facilities had been subject to enforcement actions for RCRA regulatory violations (e.g., inaccurately completed manifests), but where there did not appear to have been any releases to the environment that required cleanup. These types of cases were not included in the 208 damage case profiles, though they are identified in Appendix 3 to this report.

Types of Recyclable Materials

Exhibit 1 presents a breakdown of the primary types of materials that were recycled (or were expected to be recycled) at the site where the environmental damage occurred. Note that there is some overlap between these categories, since in many cases more than one type of material was recycled at the site. For example, while scrap metals were the primary material recycled at 17% of the sites, at many of these sites spent lead-acid batteries, or residuals from their recycling, contributed to the contamination problems at the site. Only sites where batteries were the primary material recycled (12% of sites) are identified specifically as battery damage cases.

Exhibit 1: Recycled Materials



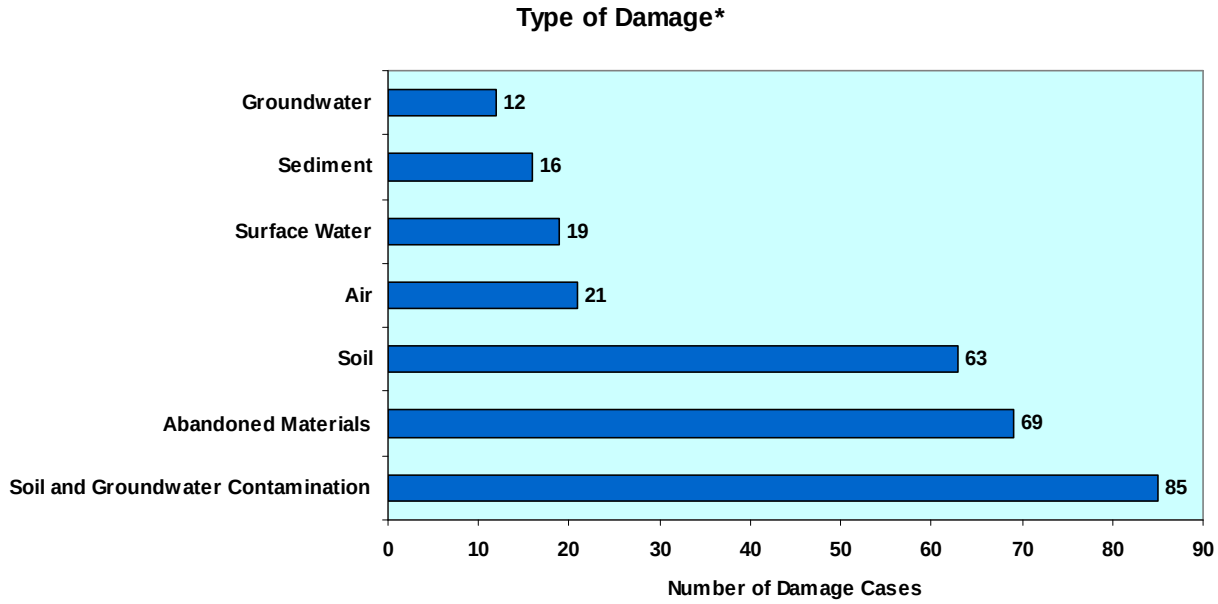
**For some damage cases, there was more than one kind of material recycled at the site. This chart includes only the material which was recycled most often at the site.*

In addition to batteries and scrap metals, other types of recyclable materials primarily managed at multiple sites include used oil (15% of sites), solvents (14%), and non-ferrous metals such as brass, aluminum, or magnesium (13%). Drum reconditioning sites accounted for 9% of the sites, precious metals 3%, and mercury 2%. "Other" types of materials account for 15% of the sites, and include a wide variety of recyclables such as foundry sands, pollution control dusts, smelting wastes, combustion ash, asphaltic wastes, etc.

Types of Environmental Damage

Exhibit 2 summarizes the types of environmental damages that were found to have occurred at the recycling sites that were investigated.

Exhibit 2: Type of Damage



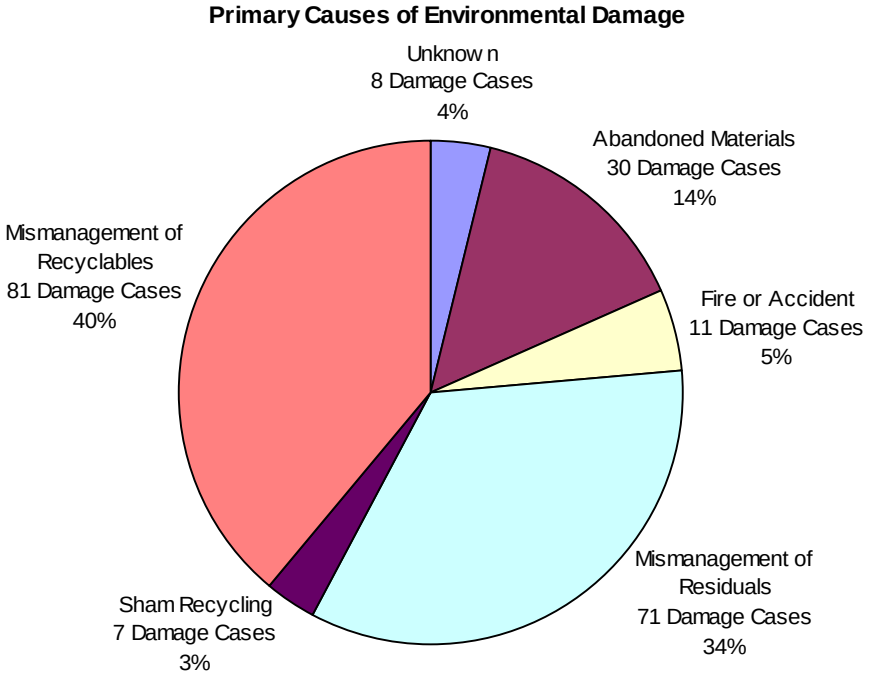
**For many damage cases, there was more than one type of damage. Every type of damage is captured in this chart, therefore there are more damage types than there are damage cases.*

Note that, as in Exhibit 1, there is some overlap with regard to the incidences of environmental damages found at the 208 sites that were documented, since at a number of sites more than one type of damage appears to have occurred (abandoned materials and soil contamination, for example). The most common type of environmental damage was a combination of soil and groundwater contamination, while a surprising number of sites (69) involved abandonment of materials. Sites involving abandoned materials included those where the materials caused environmental damages (e.g., leaking containers improperly stored out of doors), as well as those where actual environmental problems directly associated with the abandoned materials were not documented, but nevertheless required removal actions. The relatively high incidence of abandoned materials likely reflects the fact that bankruptcies or other types of business failures were associated with two thirds (138) of the sites investigated, though business failure may not have been a direct cause of the environmental problems in all cases.

Damage Causes

While our analysis did not attempt to probe in great detail the exact actions or circumstances that led to contamination problems at these sites, in most cases we were able to identify in general terms the primary cause of the contamination. These primary causes, and the number of cases attributable to them, are presented in Exhibit 3. As with Exhibit 1, there is overlap between these breakdowns for these primary causes, since for example, at a number of sites damage occurred from improperly disposed recyclables as well as the residuals generated from recycling processes.

Exhibit 3: Causes of Environmental Damage



Mismanagement of recyclable materials prior to their reclamation or reuse was the most common cause of contamination at these sites (40%), while almost as many sites involved mismanagement of recycling residuals (34%) as the primary cause. Often, at the latter category of sites, reclamation processes generated residuals in which the toxic components of the recycled materials became concentrated, and these wastes were then mismanaged. Examples of this include a number of drum reconditioning facilities, where large numbers of used drums were cleaned out to remove small amounts of remaining product such as solvent, and these wastes were then improperly stored or disposed.

Thirty of the cases that were examined for this study (14%) involved abandonment of recyclable materials as the primary cause of damage. In most of these cases, business failure appears to have been the main reason the materials were abandoned. In 5% of the cases examined (11 sites), fire and/or accident was the primary cause of damage. Seven of the cases that were examined appear to have been outright "sham" recyclers. In most of these cases,

companies advertised themselves to local generators as recyclers and accumulated considerable quantities of waste materials, but apparently did not intend to actually do any recycling. These sites were also then abandoned. For 4% of the cases we examined, we were unable to determine the primary cause of the damage.

On-Site vs. Off-Site Recycling

One of the questions we wanted to examine in this study was whether or not there may be any significant differences in the frequency, type or causes of environmental damages with regard to recycling that is conducted "on-site" (i.e., at the facility that generated the recyclable secondary materials), as compared to off-site, commercial recyclers. In the preamble to the 2003 proposed rule (68 FR at 61575) the Agency requested comment on the option of promulgating a regulatory exclusion for materials that are generated and recycled at the same facility. A number of commenters to the proposal supported this regulatory option, arguing that this type of recycling is considerably less likely to result in environmental problems than recycling at commercial, off-site facilities.

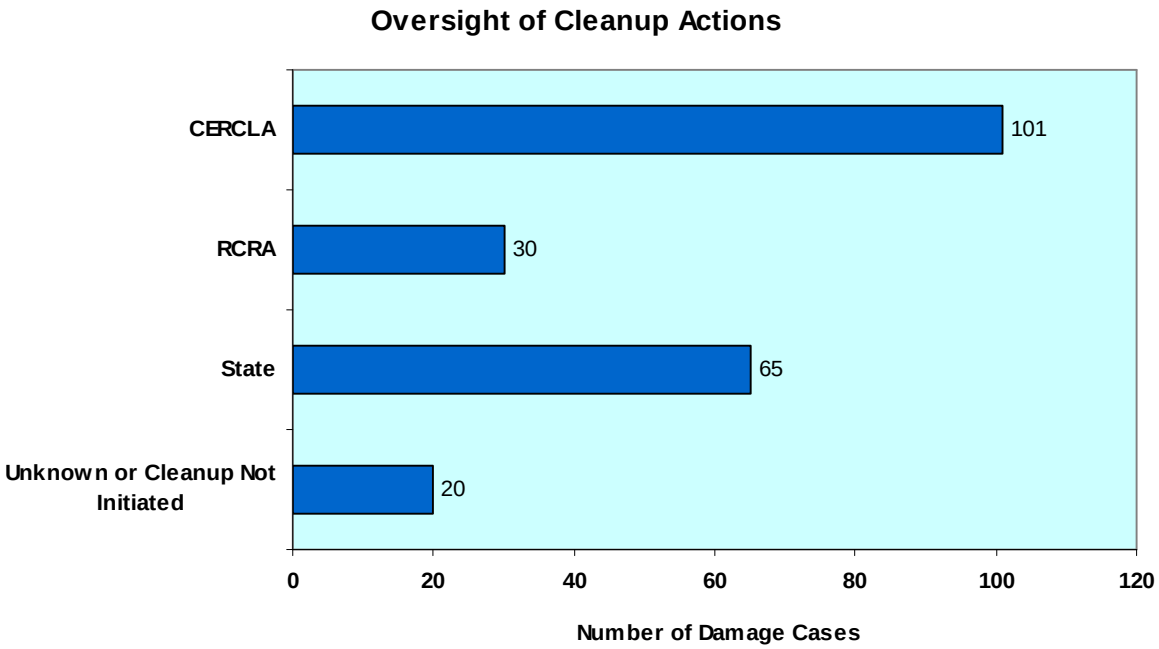
Of the 208 damage cases documented in this report, 13 (6%) involved on-site recycling by the generator, and another 7 (3%) involved on-site and off-site recycling. This relatively small number of cases may indicate that this type of recycling is inherently less environmentally "risky" than recycling at commercial facilities. However, it may also be that on-site recycling is simply a less common practice, or that these types of damage cases are less well documented, and thus more difficult to identify than cases involving commercial recyclers. In any case, it should be noted that several of the on-site damage cases, including Standard Chlorine of Delaware and the Monsanto P4 facility, were apparently among the most expensive cleanup sites that we documented.

Oversight of Cleanup Actions

The great majority of damage cases we investigated involved removal or remediation actions that were (or still are) overseen by, and often funded by, federal or state environmental cleanup programs. Exhibit 4 presents a breakdown of the cleanup programs that have been involved with oversight of these cleanup actions. Several sites were cleaned up under more than one program.

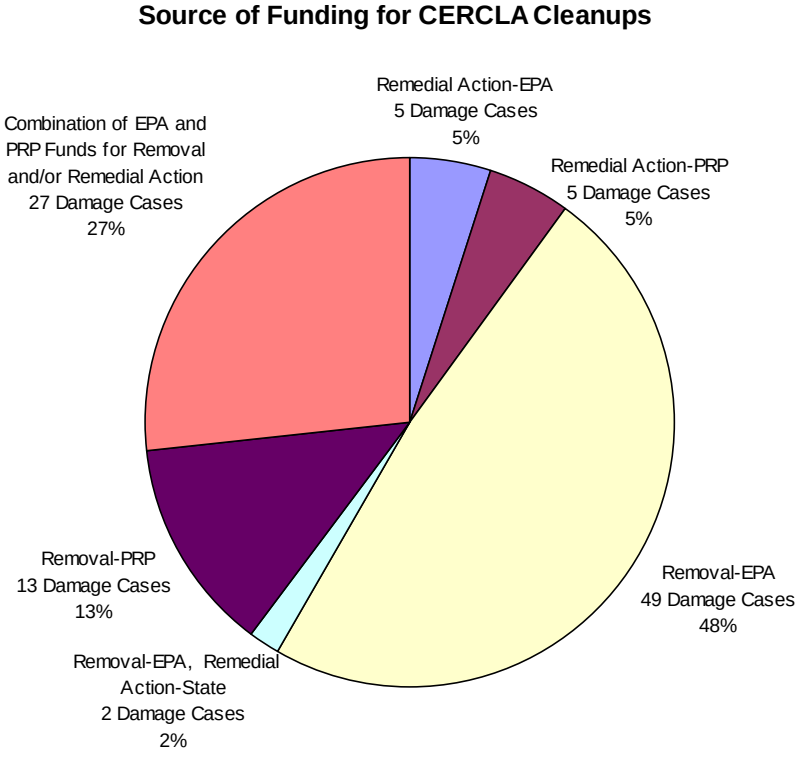
The federal CERCLA program was involved with oversight of 101 of the 208 cases that were documented, or 49%. Cleanup under CERCLA may involve emergency removal or remedial, each of which can be funded by EPA, State, or Potentially Responsible Party (PRP) funds, or a combination of these. Exhibit 5 indicates the types of cleanups that occurred under CERCLA and the funds that paid for each. Almost half (48%) of the damage cases were cleaned up under EPA-funded emergency removals, and 27% were cleaned up using a combination of funding sources and remedial and/or removal actions.

Exhibit 4: Oversight of Cleanup Actions



**For many damage cases, there was more than one type of cleanup action. Every type of cleanup is captured in this chart, therefore there are more cleanup actions than there are damage cases.*

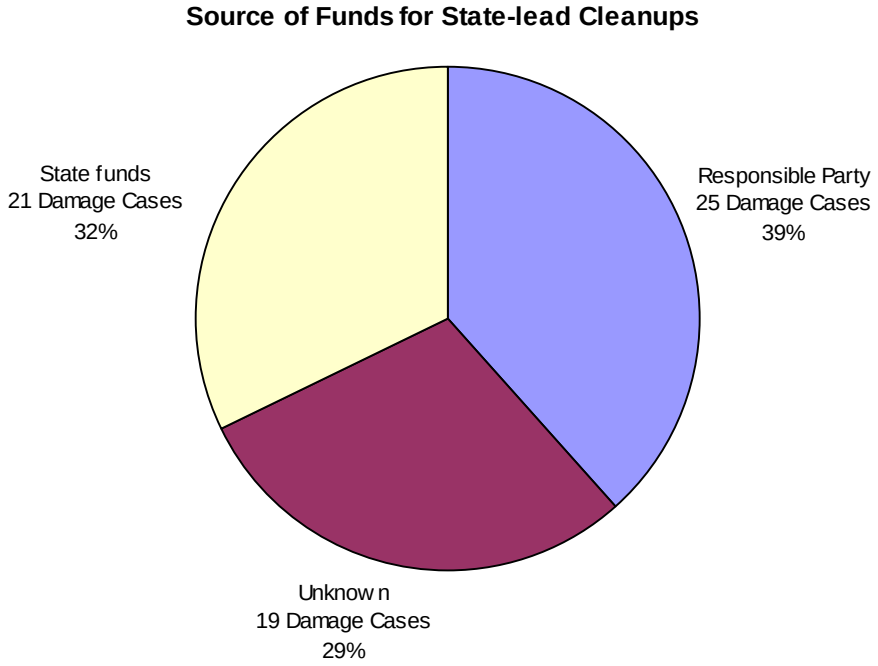
Exhibit 5: Funding of CERCLA Cleanups



Of the cases that were cleaned up under the CERCLA program, 46 were or are sites listed on the National Priorities List (NPL). Five damage cases were listed on the NPL but have not yet had cleanup initiated under CERCLA. The other 55 CERCLA cleanup cases not listed on the NPL.

State programs were responsible for oversight at 65 sites, and Exhibit 6 shows what source of funds were used for these cleanups. The results are split almost evenly among state funds, such as orphan funds or hazardous waste taxes, responsible party funds, and unknown funding. The latter group consists of site where the funding source was not clear and included cases of enforcement actions and consent decrees.

Exhibit 6: Funding of State-lead Cleanups



RCRA Corrective Action, which is administered by both states and the US EPA, was in effect at 30 sites (14%). For 20 sites, we were unable to identify which government program or agency was responsible and/or whether cleanup actions had been initiated. An example of such a case was the Thermofluids site in Oregon. Some of these sites may have been cleaned up by facility owner/operators without formal oversight from a government cleanup program.

Regulatory Status

Another issue we were interested in assessing as part of this study was the number of damage cases that occurred at facilities that, at one time or another, were operating under RCRA Part B permits. RCRA permitted hazardous waste management facilities are subject to relatively stringent, facility-specific requirements, and in general are given more oversight by regulatory agencies than facilities without permits. For these reasons, these cases are of particular interest to the Agency with regard to this regulatory initiative, and we may need to subject them to

further, more in-depth examination. The following are some preliminary findings for these damage cases.

Twenty four of the damage cases studied were, at one time or another, operating under RCRA Part B permits. However, only nine clearly appear to have been operating under RCRA permits at the time the damage occurred. Two of these cases involved fires/explosions. At thirteen of the twenty four permitted facilities, all or part of the funds used to clean up environmental damages were contributed by the owner/operator of the facility, often under some form of consent agreement. In at least two cases, it appears that these funds became available by means of a RCRA-required financial assurance mechanism, such as a surety bond.

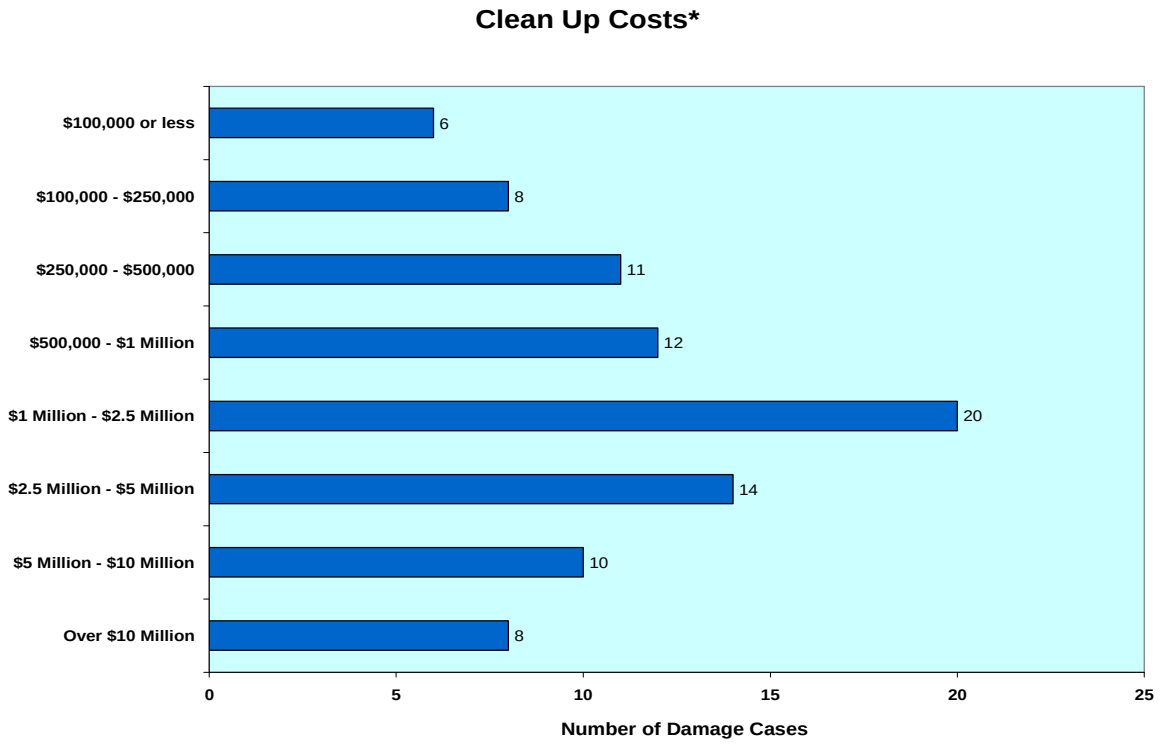
Thirteen of the facilities appear to have been cited for serious permit violations, either before or as a result of the damage incident. In four cases, the facility permits were revoked because of compliance issues. Eleven of the facilities were found to be no longer in business, because of bankruptcy or for other reasons.

One company - Safety Kleen - a large, commercial recycler primarily of solvents and other hazardous materials, was the owner/operator of five of the permitted facilities.

Cleanup Costs

For 89 of the damage cases, we were able to identify the costs, or at least cost estimates, associated with addressing the environmental problems caused by recycling activities. A breakdown of these costs is presented in Exhibit 7.

Exhibit 7: Clean Up Costs



**Cleanup costs may include costs for cleanup at the site not related specifically to damage from recycling operations.*

It is entirely possible that these cost data are not a truly accurate representation of actual cleanup costs for the entire sample of 208 cases. For one thing, cost data were much easier to find for CERCLA-lead cleanups than cleanups done under other programs. Since CERCLA-lead cleanups are likely to be skewed toward addressing relatively large, high-priority, expensive contamination sites, the actual cleanup costs for all 208 cases are likely to be somewhat lower than these data suggest.

Another uncertainty with regard to these cost data is that in some cases, it was not possible to distinguish between cleanup costs that were incurred specifically to address recycling-related contamination, and costs for other cleanup activities at the site. The Metachem (also known as Standard Chlorine) site in Delaware, where total cleanup costs are expected to exceed $75 million, is one example of such a site.

Additional Information

Further information is available in the attached appendices. Appendix 1 of this report is a summary table of the cases, and is organized alphabetically by State. Appendix 2 contains each of the 208 case descriptions, organized in the same way. Appendix 3 is a listing of the damage cases that were reviewed but were not investigated in detail, either because they did not fit within the scope of the study, or because there was insufficient information to make that determination.